

IAEA Coordinated Research Project on Development of a Database for Prompt-Gamma Neutron Activation Analysis

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Neutron induced prompt gamma activation analysis (PGAA) is a non-destructive radio-analytical method capable of identifying nearly the entire periodic table. Availability of high-quality thermal and cold neutron beams has facilitated the development of PGAA. This method has been applied to materials science, chemistry, geology, mining, archaeology, environment, food analysis, medicine and other areas. Inaccurate and incomplete data available for PGAA are a significant handicap to its development. These deficiencies were recognized during the meeting on the Coordination of the Nuclear Structure and Decay Data Evaluators' Network held at Budapest in 1996 and have led to the IAEA CRP, starting in 1999 for three years, that is described here.

The goals of the CRP are to

1. Generate a recommended database containing energies, intensities, isotope assignments and prompt k_0 -factors for about 80 chemical elements, and make it available for analytic users.
2. Complete, renormalize, and improve the ENSDF isotopic data.

The data to be evaluated in this effort include

1. Capture gamma-ray energies and absolute intensities for the dominant isotopes of each chemical element.
2. Thermal and cold neutron capture cross sections for dominant isotopes.
3. Correction factors to account for deviations from the $1/v$ law.
4. k_0 -factors for all elements.

The primary tasks for the CRP participants will be to

1. Evaluate capture gamma-ray data for $A < 45$ not currently in ENSDF
2. Update the remaining ENSDF capture gamma-ray data and check the intensity normalizations.
3. Reevaluate thermal capture cross section data or evaluations.
4. Create a database for isotopes containing gamma-ray energies and intensities from the updated isotopic ENSDF data.
5. For each element, combine the ENSDF isotopic data with newly measured elemental data from Budapest, ORNL, and elsewhere and renormalize the intensities, as necessary, to deduce a recommended set.
6. Make the new library available for users (WWW, CD-ROM, IAEA Report).

The end product will be a catalogue of neutron capture data for PGAA in printed and electronic forms. Up-to-date capture gamma datasets will be prepared in ENSDF format with only minimal evaluation of nuclear structure information such as J^π and half-life. For strong transitions, the new elemental data give energies to within a few tens of eV and intensities to better than 2% for most elements. Corresponding cross section uncertainties should likewise be reduced to <2% for many isotopes. Full normalization information will be provided in the ENSDF format data for each isotope. These data will supercede the information available from the Lone table.

* *Prompt Gamma Rays from Thermal-Neutron Capture*, M. A. Lone, R. A. Leavitt, D. A. Harrison, Atomic Data and Nuclear Data Tables 26, 511 (1981).